

# STUDIES IN LINUM: L. IMBRICATUM AND L. HUDSONIOIDES<sup>1</sup>

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On the basis of two or three seemingly minor features Planchon (London Jour. Bot. 7: 185-186. 1848) distinguished two closely related species of flax of Texas, *Linum multicaule* Hook. (= *L. imbricatum* [Raf.] Shinnery) and the new *L. hudsonioides* Planchon. Later Asa Gray (Pl. Lindheim., Boston Jour. Nat. Hist. 6: 155-156. 1850) somewhat hesitantly maintained both, but subsequently (Pl. Wright., Smithson. Contr. Knowl. 3: 27. 1852) decided that the two were not separable. Since that time they have been treated as a single species. This species has been readily distinguished from other flaxes with united styles by the numerous, small, closely appressed, imbricated leaves and the sepals with broadly scarious, nonglandular margins.

An examination of the rather plentiful herbarium material reveals two clear-cut populations which, though very much alike in habit, are easily separated by a number of characteristics and it is evident that *L. hudsonioides* should properly be recognized. The following table lists the more obvious

TABLE 1. A comparison of *L. imbricatum* and *L. hudsonioides*.

| <i>L. imbricatum</i>  | <i>L. hudsonioides</i>  |
|---|---|
| Pedicels and upper part of the stem hirsute                                     | Pedicels and upper part of the stem hirsutulous                             |
| Upper leaves ciliate-margined   | Upper leaves not ciliate-margined   |
| Lower, longer pedicels (2-) 4-6 (-11) mm averaging about 5 mm long <sup>2</sup> | Lower, longer pedicels (3-) 8-13 (-15) mm averaging about 10 mm long        |
| Outer sepals, like the inner, prominently toothed                               | Outer sepals entire or nearly so  |
| Cartilaginous portion of false septum conspicuously broadened below             | Cartilaginous portion of false septum uniformly narrow or absent throughout |

<sup>1</sup>Contribution No. 94 from the Department of Biology, Wayne State University.

<sup>2</sup>Dimensions, when based on 25 or more measurements, are shown in the following way: (2-) 4-6 (-11) mm long indicates a total range of 2-11 mm, with approximately 60% of the individuals being 4-6 mm long.



Hyaline portion of false septum appressed pilose along the inner margin, otherwise essentially glabrous

Seeds biconvex

Unopened anthers 0.6-1.2 mm averaging less than 0.9 mm long

Hyaline portion of false septum conspicuously tomentose near the summit

Seeds three angled

Unopened anthers 1-1.6 mm averaging more than 1.2 mm long

of these features, some of which are shown in the accompanying illustrations (Figs. 1-9).

Pedicle length and other more subtle differences in leafiness of the upper part of the stem, divergence of the branches and stature enable one to recognize perhaps nine of ten individuals without resorting to the other characters listed. Though probably not the most significant difference, the type of pubescence is perhaps the most easily observed and once the two taxa have been compared for this feature, specimens may be readily sorted on the basis of pubescence alone, since there appears to be virtually complete correlation between this and the other features.

There is very little evidence of hybridization between the two species (*Letterman*, July 1880, Denison, Texas (MO) and perhaps *Tharp*, Apr. 22, 1931, Bastrop, Texas (TEX) can be interpreted as being intermediate) and, as shown in Fig. 10, they occupy nearly distinct geographical ranges.

The species are clearly related to *L. rigidum*, which they resemble rather closely in the annual habit, shape and mode of dehiscence of the fruit, development of complete false septa, union of styles and pollen morphology.

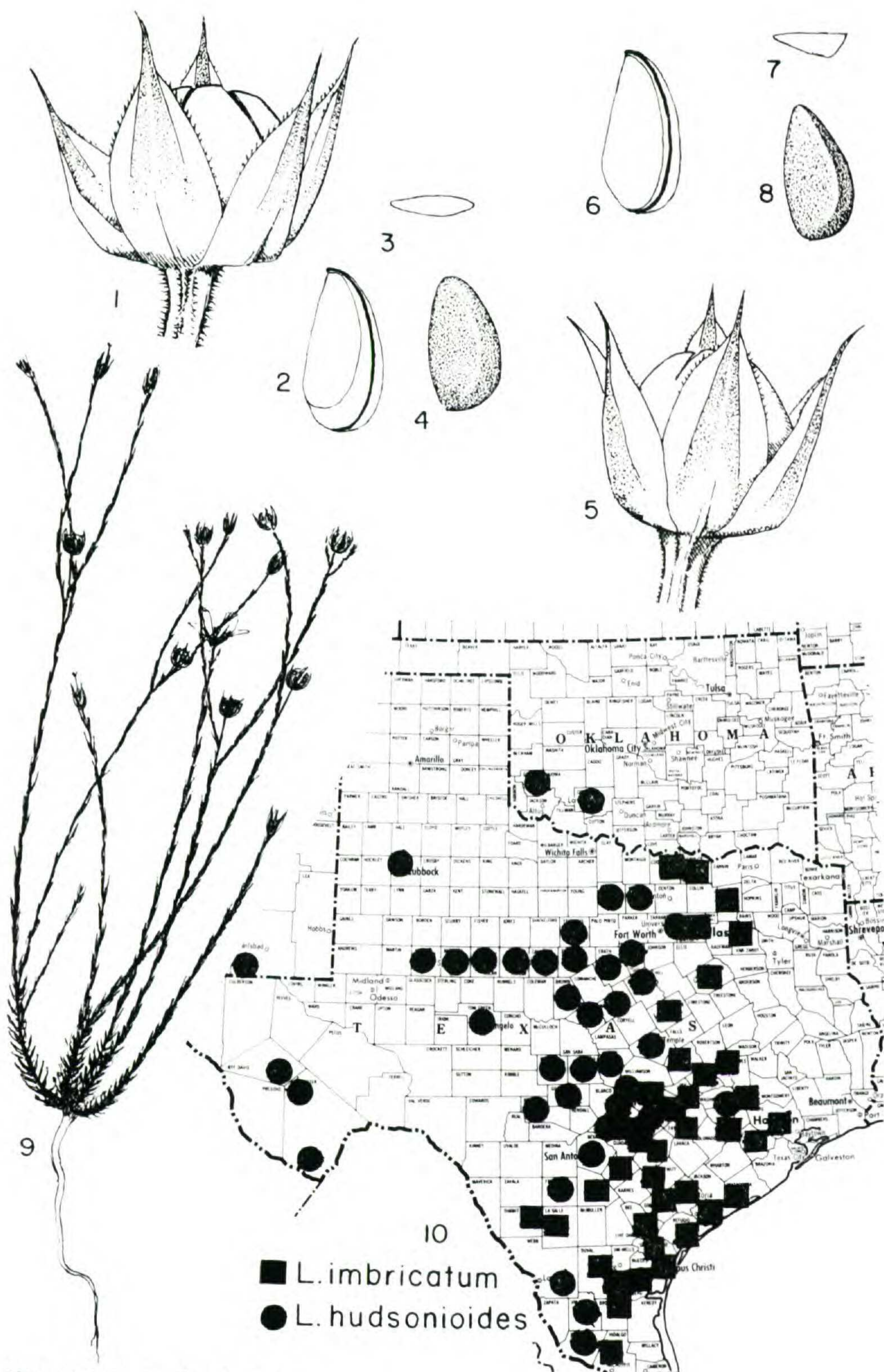
***Linum imbricatum*** (Raf.) Shinnars, Field & Lab. 25: 32. 1957. Fig. 1-4.  
*Nezera* (or *Linum*) *imbricata* Raf. New Fl. and Bot. N. Amer. 4: 66. (1836) 1838.

*Linum multicaule* Hook. in T. & G. Fl. N. Amer. 1: 678. 1840.

*Cathartolinum multicaule* (Hook.) Small, N. Amer. Fl. 25: 84. 1907.

Low annual herb (6-) 11-20 (-27) cm tall, from a slender tap root, branched at the base, sometimes divaricately so in plants along the Gulf shore; stems spreading-ascending or erect, terete or nearly so at the base, strongly striate above, glabrous below, conspicuously short-hirsute with stout-based hairs above; leaves narrow, opposite near the base, alternate above, the larger (5-) 6-8 (-9) mm long, (0.5-) 0.7-0.9 (-1.2) mm wide, strongly imbricate, the lower spreading-





Figs. 1-8,  $\times 6$ ; Fig. 9,  $\times 3/5$ .

Figs. 1-4. *Linum imbricatum*. Fig. 1. Fruit. Fig. 2. Carpel. Fig. 3. Cross-section of seed. Fig. 4. Seed.

Figs. 5-9. *Linum hudsonioides*. Fig. 5. Fruit. Fig. 6. Carpel. Fig. 7. Cross-section of seed. Fig. 8. Seed. Fig. 9. Habit

Fig. 10. Distribution of *L. imbricatum* and *L. hudsonioides*. Not shown are two collections of *L. hudsonioides* from Saline and Sedgwick Counties, Kansas.



ascending, the cauline rather strongly appressed, with conspicuous cartilaginous-based midribs, short-awned, the upper ciliate-margined; stipular glands none; inflorescence few-flowered, the lower, longer pedicels (2-) 4-6 (-11) mm long, the upper mostly hidden by the subtending leaves; sepals 5, persistent, usually with a few stiff hairs along the midrib, ovate, (4.2-) 4.6-5.5 (-6.1) mm long, with broad, commonly purplish, scarious margins, prominently toothed above the middle, the median herbaceous portion extended into an awn; petals 5, fugacious, yellow, with or without a darker base, obovate, 6.5-8 mm long, pilose at the base inside; stamen tube short; staminodia none; stamens 5; filaments about 5 mm long; anthers elliptic, 0.6-1.2 mm long before dehiscence; fruit pale, completely 10-celled, broadly ovate, 2.6-3 mm high, 2.9-3.3 mm in diameter, splitting freely at the false septa into 5 parts; true septa cartilaginous; false septa appressed pilose along the inner margin, otherwise essentially glabrous, mostly hyaline, but with a cartilaginous portion along the ovary wall, this cartilaginous strip conspicuously broader toward the base of the carpel; styles 5, 2-4.3 mm long, united to within 0.3-0.8 mm of the stigmas; stigmas capitate; seeds 10, flattened, ovate, 2-2.6 mm long, 1.1-1.5 mm wide, reddish brown.

In predominantly sandy soil in the Blackland and Coastal Prairies throughout east central Texas.

Type: San Felipe (Austin County), Texas, *Drummond 37*, Coll. 3. Though the specimen, received from Torrey, from which Rafinesque drew his description of *Nezera imbricata*, is probably not extant, there is little question but that it was one of the several plants distributed under this number. A sheet from the Torrey herbarium (NY) was almost certainly erroneously labelled "II, 47", accounting for some confusion as to the correct collection number. The original citation of Hooker's *L. multicaule* (in T. & G., Fl. of N. Amer. 1:205. 1838, as *L. selaginoides* Lam.) was Collection 2, 47 (37?), later (T. & G. *op. cit.*: 678. 1840) changed to Collection 2, 37, but the specimen in the Hooker herbarium (K), upon which the name was based is Collection 3, 37. Other similar specimens, here considered isotypes, have been seen at GH and NY.

About 100 collections were examined of which the following are representative.<sup>3</sup>

TEXAS: ARANSAS: *Whitehouse 18163* (SMU); ATASCOSA: *Schulz 81* (US); BASTROP: *Barkley et al. 7037* (OKLA, TEX); BEE: *Shinners 9889* (SMU); BRAZOS: *Parks, May 1, 1947* (OKLA, TEX); BROOKS: *Cory 55231* (SMU, US); BURLESON: *Fisher 31* (F); CALDWELL: *McBoyce, 1931* (TEX); CALHOUN: *Tharp, May 22, 1930* (TEX); COOKE: *Shinners*

<sup>3</sup>Specimens are cited alphabetically by state and then county and only one collection per county is given. For the eleven herbaria from which material was borrowed, the usual abbreviations are given. The assistance of the respective curators is gratefully acknowledged.



12410 (SMU); DALLAS: *Reverchon*, May, 1875 (GH, NY); DE WITT: *Riedel*, Mar 15, 1942 (TEX); DIMMIT: *Lundell* 13603 (US); DUVAL: *Croft* 101 (NY); FAYETTE: *Johnston & McCart* 5167 (TEX); FORT BEND: *Bray* 106 (US); GOLIAD: *Williams* 41 (TEX); GONZALES: *Tharp*, May 21, 1936 (MICH); GRAYSON: *Letterman*, Jul, 1880 (MO); HARRIS: *Tharp* 2293 (TEX); HAYS: *Baker* 35 (TEX); HIDALGO: *Runyon* 1703 (US); HUNT: *Shinners* 12245 (SMU); JIM WELLS: *Drushel* 6504 (MO); KLEBERG: *Reed* 54 (NY); LA SALLE: *Reverchon*, Apr 29, 1905 (OKL); LEE: *Cory* 55761 (SMU); MATAGORDA: *Palmer* 9674 (MO, US); MCLENNAN: *Smith* 426 (TEX); MILAM: *Fisher* 3151 (US); NAVARRO: *Joor*, June 8, 1880 (MO, US); NUECES: *Heller* 1389 (F, MICH, MO, NY, OKL, SMU, US); SAN PATRICIO: *Williges* 380 (SMU); TRAVIS: *Rehm*, May 1, 1935 (TEX p.p.); VAN ZANDT: *Van Fleet* 1217 (SMU); VICTORIA: *Eggert*, Apr 10, 1900 (MO); WALLER: *Hall* 64 (F p.p., GH, MO, NY, US); Wilson: *Parks & Cory* 7779 (TAES).

***Linum hudsonioides*** Planchon, London Jour. Bot. 7:186. 1848. Fig. 5-9.

Annual herb with a slender taproot, closely resembling *L. imbricatum* in habit, (5-) 11-23 (-30) cm tall; stems scabrous or hirsutulous on the angles above, otherwise glabrous, branching from the base, ascending to erect, nearly terete below, prominently striate above; leaves narrow, opposite near the base, alternate above, the larger (5-) 6-8.5 (-10) mm long, (0.5-) 0.7-0.9 (-1.1) mm wide, imbricated throughout, the lower spreading-ascending, the cauline closely appressed, the lower sharp-pointed, the upper with a short slender terminal awn, all entire, the uppermost with a narrow scarious margin; stipular glands none; inflorescence few-flowered, the lower, longer fruiting pedicels (3-) 8-13 (-15) mm long, all usually conspicuously exserted beyond the subtending leaves; sepals 5, persistent, the outer lanceolate-ovate, (4.5-) 5.5-6.2 (-7.2) mm long, with a very broad, scarious, entire or sparsely delicately toothed, or in age somewhat lacerate, margin, the slender herbaceous median portion extending into a conspicuous awn, the inner sepals similar, but more prominently toothed; petals 5, fugacious, obovate, yellow, with or without a darker basal portion, 8-12 mm long, pilose at the base inside; stamen tube short; staminodia none; stamens 5, filaments about 5 mm long; anthers elliptic, 1-1.6 mm long before dehiscence; fruit pale, completely 10-celled, broadly ovate, 2.7-3.5 mm long, 2.8-3.6 mm in diameter, splitting freely at the false septa into 5 parts; true septa cartilaginous; false septa tomentose near the summit, entirely hyaline, or with a uniformly very narrow outer cartilaginous portion; styles 5, 2.7-6.3 mm long, united to within 0.3-1.1 mm of the stigmas; stigmas capitate; seeds 10, ovate, 2-2.7 mm long, 1-1.2 mm wide, wedge-shaped in cross-section, reddish brown.

In sandy or gravelly, granitic or occasionally calcareous soil, principally in the eastern Plains Country and the Edwards Plateau areas



of Texas, with outlying stations in Trans-Pecos Texas and southeastern New Mexico and in the Wichita Mts. of Oklahoma. Two additional collections, perhaps questionable, have come from central Kansas.

Type: Entre Bejar y el rio de la Trinidad, *Berlandier* 385, May, 1828 (K, not seen). Possible isotype, a poor specimen, at GH (dated Mar 20, 1828).

About 100 collections were examined of which the following are representative.

KANSAS: SALINE: *Letterman*, Aug 24, 1884 (US); SEDGWICK: *Sears*, Jun 9, 1928 (OKL); NEW MEXICO: EDDY: *Ripley & Barneby* 2593 (NY); OKLAHOMA: COMANCHE: *Orr* 313 (SMU); GREER: *Waterfall* 7246 (OKL, OKLA); TEXAS: BASTROP: *Thorp*, Apr 22, 1931 (TEX); BELL: *Wolff* 2897 (TAES); BEXAR: *Schulz* 44 (US); BOSQUE: *Van Fleet* 52 (SMU); BREWSTER: *Mueller* 8056 (TEX); BROWN: *Reverchon* 1294 (MO); BURNET: *Barkley & Rowell* 62 (TEX); CALLAHAN: *Letterman*, Aug 10, 1882 (MO, NY, US); COMAL: *Pennell* 5457 (NY); DALLAS: *Reverchon* 109 (US p.p.); EASTLAND: *Tharp*, Apr, 1937 (NY); ERATH: *Gough*, May 16, 1921 (TEX); FRIO: *Higdon* 53-139 (TEX p.p.); GILLESPIE: *Barkley et al.* 47253 (TEX); HAMILTON: *Reverchon*, Apr, 1882 (GH); HAYS: *Stanfield*, Apr 1, 1897 (NY); HOOD: *Eggert*, May 6, 1900 (MO); HOWARD: *Parks & Cory* 12520 (TAES); JACK: *Shinners* 12347 (SMU); JEFF DAVIS: *Girard*, Ft. Davis (GH); JIM HOGG: *Tharp*, Jun 15, 1928 (TEX); KERR: *May* 555 (SMU); LLANO: *McCart* 5673 (SMU); LUBBOCK (or LAMB): *Tharp* 6309 (TEX); MASON: *Shinners* 26296 (SMU); MILLS: *McWhorter*, Apr 17 (TEX); MITCHELL: *Pohl* 5106 (SMU); NOLAN: *Palmer* 12469 (MO, US); STARR: *Clover* 1097 (NY); STEPHENS: *Deaton*, Jun 15, 1931 (GH, MICH, TEX); TAYLOR: *Tolstead* 7038 (MICH, NY, SMU, TEX); TOM GREEN: *Tweedy* 110 (US); TRAVIS: *Birge* 999 (TEX); WALLER: *Hall* 64 (F p.p.); WEBB: *Salazar et al.* 10 (OKLA); WISE: *Shinners* 26105 (SMU).